



## WELL REAMER

## Field of Invention

The invention relates to drilling technique, in particular, to devices for borehole reaming within specified interval.

## Description of Related Art

There is known a well reamer, comprising a housing with inclined slots and a piston, placed in it ~~which is~~ and spring-loaded through a rod, legs with journals fixed in inclined slots of the housing, on which journals rolling cutters are ~~set as a cantilever~~ <sup>provided</sup> ~~provided~~ (Inventor's certificate of the USSR No 582373, class E21B 7/28, 19771).

A shortcoming of the known device is lack of its reliable centering in a well, since its design does not allow to locate on its housing more than two operating elements <sup>no</sup> without detriment to its strength. This results in their vibration and whipping <sup>during</sup> in the process of well reaming. In so doing the surface of the reamed well section becomes irregular, which does not allow to provide qualitative installation of profile liner in isolation of trouble zones during wells drilling. Rate of borehole reaming is also low.

<sup>Additionally</sup> ~~Besides~~, in the known reamer the rolling cutters are fixed on legs as a cantilever <sup>secured</sup> without ~~fixing~~ the free ends of journals, which lowers the strength of operating elements and leads to their break at ~~increase of~~ <sup>heavy</sup> mechanical loads.

~~Most close to suggested one by most coinciding features~~ There <sup>another known, which comprises</sup> is a reamer, comprising a housing with inclined slots and a central straight-through channel, in which a rod is placed and spring-loaded towards the lower end of the housing, legs with journals fixed in inclined slots of the body, on which journals rolling cutters are ~~set, and supports, in which~~ <sup>provided and supported</sup> free ends of legs' journals are fastened, <sup>and interact</sup> interacting with the rod through pushers (Patent of the Russian Federation No 2172385 class E21B 7/28, 2001).

Shortcoming of this device <sup>include</sup> are low serviceability and reliability due to presence in its design of a ring piston, rigidly connected with the rod, and pushers of supports in the form of two-member links, ~~which cannot withstand~~ <sup>Additionally</sup> ~~not notwithstanding~~ heavy power loads. <sup>the</sup> Besides, the design of the known reamer does not allow to exercise control over setting of its operating elements into working position.

### Summary of the Invention

An object of the invention is to increase of serviceability and reliability of the reamer.

The object is attained by a well reamer, comprising a housing with inclined slots and a central straight-through channel, in which a rod is placed and spring-loaded towards lower end of the housing, ~~legs having journals fixed in inclined slots of the housing, on which journals rolling cutters are set, and supports, in which free ends of legs' journals are secured, interacting with the rod through pushers~~. According to the invention, the pushers of supports are made in the form of cylindrical pistons, placed in inclined bores of the housing and tightened relative to its straight-through channel and annulus environment, of which some ends are connected with supports, and others are fixed on the rod with the possibility of radial movements with respect to its walls, ~~where the central straight-through channel of the housing communicates with annulus environment through first and second holes made in walls of the housing and the rod, being covered while extending the legs with cutters into working position~~. ~~These holes are~~ ~~and the~~ ~~to an operating~~

### Brief description of the drawings *is a longitudinal section of a reamer in accordance with the present invention*

Fig. 1 shows the reamer in transport position, *longitudinal section*, Fig. 2 — same, in reaming of hole; Fig. 3 — *section A-A in Fig. 1*, *sectional view taken on III-III in Fig. 1* *shows the reamer of Fig. 1 in the operating position*

### Detailed description of the preferred embodiment

A well reamer (Fig. 1) comprises a housing 1 with a central straight-through channel 2, in which rod 3 is placed and spring-loaded by a spring 4 towards the lower end of the housing 1, the spring 4 is positioned in a chamber 5, ~~which is formed~~ ~~created~~ by an inner wall of the housing 1 and an outer wall of the rod 3. The chamber 5 communicates through first holes 6, ~~made~~ in the wall of the housing 1, with environment and through second holes 7 in the wall of the rod 3 — with the central straight-through channel 2 of the housing 1. The chamber 5 is isolated from the straight-through channel 2 by seals 8, and the second holes 7 of the rod 3 are ~~made with the possibility of their covering~~ ~~may be covered~~ by a thrust bushing 9 after the rod 3 has come to the upper most position.

The housing 1 has outer inclined first slots 10 (Fig. 1, 3) of "dovetail" type, in which legs 11 with journals 12 are fastened, ~~on which~~ ~~provided for~~ ~~about the journals 12.~~ cutters 13 with hard-alloy teeth 14 are set with the possibility of rotation. The legs 11, acting as calibrators are provided with ~~the supports~~ ~~which are also~~ similar teeth. Free ends 15 of the journals 12 are ~~fixed in supports 16, installed also in the~~

inclined first slots 10 of the housing 1 and rigidly connected with cylindrical pistons 17, arranged in inclined bores 18 of the housing 1. The pistons <sup>3 are</sup> ~~have~~ ends 19 ~~by~~ <sup>and</sup> ~~which may~~ secured in third holes 21 of the rod 3 with the possibility of radial movements. The bores 18, through a longitudinal second slot 22 of the housing 1, communicate with the straight-through channel 2 of the housing 1 and are isolated from the environment by seals 23.

On ends of the housing 1 some threads are ~~made~~ <sup>provided</sup> a thread 24 for connection with drill string 25 (Fig. 2) through a reducer 26, and a thread 27 for attaching of a drilling bit having bean washout ports (not shown).

The well reamer operates in the following way.

A drilling bit (not shown) is screwed in the thread 27 of the housing 1, and the reducer 26 is screwed on the thread 24, the reamer is connected to the drill string 25 and ~~run~~ <sup>inserted</sup> into a well 28 (Fig. 2).

At the prescribed well depth, one starts rotation of the drill string 25 ~~with~~ <sup>and</sup> simultaneously supply into it ~~a~~ of washing fluid, which flows into the central straight-through channel 2 of the housing 1 and further – into washout ports of the bit, in which differential pressure is created. As the differential pressure above the bit increases, pistons 17 connected with the rod 3 by the sliders 20 overcomes the power of spring 3 and moves the supports 16 ~~with~~ <sup>and</sup> the cutters 13 ~~fastened in them using the journals 12~~, and the legs 11 along the inclined first slots 10 into ~~the operating~~ <sup>position</sup>, up to the stop at an end face 29 of the reducer 26. At that the fluid from the chamber 5 is displaced into annulus environment of the well 28 through the first holes 6 of the housing 1, while the second holes 7 in the rod 3 are covered by the thrust bushing 9, ~~that~~ <sup>which</sup> results in ~~creating~~ <sup>increase</sup> an abrupt pressure ~~jump~~ <sup>in</sup> the reamer ~~towards its increase~~ and serves as a signal of operating elements (the legs 11 and the cutters 13) of the reamer ~~having been~~ <sup>have</sup> extended into ~~the operating~~ <sup>position</sup>. Further, by ~~the reamer feed~~ <sup>moving</sup> downward, the well is reamed within a specified interval.

Upon completion of the borehole reaming, the fluid injection into the drill string 25 is ceased. In so doing the spring 4, being extended, returns the rod 3 and ~~connected therewith~~ <sup>the pistons 17</sup> as well as the supports 16 and the legs 11 with the cutters 13 <sup>to</sup> a transport position.

In ~~extension~~ <sup>moving</sup> of the operating elements ~~into~~ <sup>between the</sup> a working position and ~~then~~ <sup>returning to the</sup> transport position, the sliders 20, ~~rigidly connected with~~ <sup>which have to</sup> the pistons 17, ~~while moving through~~ <sup>moving through the</sup> second slots 22 in the housing 1, make radial movement in the third holes 21 of the rod 3 – ~~moving out of them and moving in~~ <sup>into and out of the third openings</sup> <sup>(openings)</sup>.

Such a design of the reamer ~~at the expense of more~~ <sup>4 provides an</sup> improved mechanism ~~for~~ ~~operating~~ ~~elements~~ ~~extension~~ into ~~working~~ position and ~~provision~~ ~~for~~ control over ~~the~~ extension increases its serviceability and reliability. ~~of the reamer~~